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595 MINER ROAD
CLEVELAND, OH 44143

EXAMINER	
CORBETT, JOHN M	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/534,158	Applicant(s) BONTUS ET AL.	
	Examiner JOHN M. CORBETT	Art Unit 2882	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 13 August 2008.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-20 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) 1-5 and 20 is/are allowed.

6)☒ Claim(s) 6,7 and 15-17 is/are rejected.

7)☒ Claim(s) 8-14 and 18-19 is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on 23 January 2008 is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

1. Claim 6 is rejected under 35 U.S.C. 102(b) as being anticipated by Turbell et al. ("An improved PI-method for reconstruction for helical cone-beam projections", 24-30 October 1999, Nuclear Science Symposium, 1999, IEEE, pages 865-868).

With respect to claim 6, Turbell et al. (p865) teaches a method, comprising:

producing measuring values indicative of radiation that traverses an examination zone and is detected by a radiation sensitive detector (Figure 1); and

reconstructing the measuring values as a function of corresponding projection angles and weighting factors dependent on the location of the measuring value on the detector (Page 865, step 1, pre-weighting with cosine of the cone-angle) to generate an image indicative of the examination zone (including Step 4 of introduction and Figures 6-8).

2. Claims 6-7 and 17 are rejected under 35 U.S.C. 102(b) as being anticipated by Proksa et al. ("The n-PI-Method for Helical Cone-Beam CT", 2000, IEEE Transactions on Medical Imaging, Volume 19, Number 9, Pages 848-863).

With respect to claims 6-7, Proksa et al. discloses a method, comprising:

producing measuring values indicative of radiation that traverses an examination zone and is detected by a radiation sensitive detector (Page 849, Col. 1, lines 11-23 and Figures 1-2); and

reconstructing the measuring values as a function of corresponding projection angles (Figures 12-15) and weighting factors dependent on the location of the measuring value on the detector (to include Page 853, Col. 1, step 3, preweighting with cosine of cone-beam angle) to generate an image indicative of the examination zone (Figures 12-15), a projection angle is the angle enclosed by a PI line of an object point projected in a plane perpendicular to an axis of rotation (Figure 6).

With respect to claim 17, Proksa et al. discloses a system (to include Page 849, Col. 1, lines 18-19 and Figures 1-2), comprising:

a detector that detects radiation from a conical radiation beam traversing an examination zone and that generates measuring values indicative of the detected radiation (to include Figures 1-2 and Table 1); and

necessarily a reconstructor (projections reconstructed, see for example Figures 12-15) that integrates the measuring values over projection angles corresponding to angles enclosed by a PI line of an object point projected in a plane perpendicular to an axis of rotation (Figure 6);

the measuring values are multiplied by a weighting factor dependent on the location of the measuring value on the detector (to include Page 853, Col. 1, step 3, preweighting with cosine of cone-beam angle).

3. Claims 15-16 are rejected under 35 U.S.C. 102(b) as being anticipated by Katsevich ("Analysis of an exact inversion algorithm for spiral cone-beam CT", 7 August 2002, Phys. Med. Biol., Volume 42, Pages 2583-2597).

With respect to claim 15, Katsevich (2002) discloses a method, comprising:

identifying a first voxel from a plurality of voxels within an examination zone to reconstruct (Abstract, Pages 2584-2586, Section 2. The main inversion formula, Pages 2586-2587, Section 3 Two particular cases of the inversion formula, including Theorem 2, Equation 15 and Figure 2); and

reconstructing the first voxel as a function of a first set of corresponding projection angles indicative of angles at which a radiation beam traverses the first voxel (Abstract, Pages 2584-2586, Section 2. The main inversion formula, Pages 2586-2587, Section 3 Two particular cases of the inversion formula, including Theorem 2, Equation 15 and Figure 2).

With respect to claim 16, Katsevich (2002) further discloses reconstructing at least a second voxel, from the plurality of voxels, as a function of a second set of corresponding projection angles indicative of angles at which the radiation beam traverses the second voxel (Abstract, Pages 2584-2586, Section 2. The main inversion formula, Pages 2586-2587, Section 3 Two particular cases of the inversion formula, including Theorem 2, Equation 15 and Figure 2).

4. Claims 15-16 are rejected under 35 U.S.C. 102(e) as being anticipated by Katsevich (6,574,299).

With respect to claim 15, Katsevich ('299) teaches a method, comprising:

identifying a first voxel from a plurality of voxels within an examination zone to reconstruct (including Step 51 where x is voxel in 3D reconstruction); and

reconstructing the first voxel as a function of a first set of corresponding projection angles indicative of angles at which a radiation beam traverses the first voxel (including Step 50 and Figure 2).

With respect to claim 16, Katsevich ('299) further teaches further including reconstructing at least a second voxel (including Step 58), from the plurality of voxels, as a function of a second set of corresponding projection angles indicative of angles at which the radiation beam traverses the second voxel (including Step 50 and Figure 2).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Turbell et al. as applied to claim 6 above, and further in view of Proksa et al.

With respect to claim 7, Turbell et al. discloses the method as recited above.

Turbell et al. further discloses a projection angle is the angle enclosed by a PI line (Abstract and Section II PI-SURFACES, where the set of all PI-lines belonging to the same projection form a PI-surface).

Turbell fails to disclose an object point projected in a plane perpendicular to an axis of rotation.

Proksa et al. teaches an object point projected in a plane perpendicular to an axis of rotation (Figure 6).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the method of Turbell et al. to include the perpendicular projection of Proksa et al., since a person would have been motivated to make such a modification to reduce computational complexity of a three dimensional problem by determining the range of projection angles which will contribute to the reconstruction of a group of object points which will enter and leave the cone-beam simultaneously by as a simpler two-dimensional problem (Page 848, Col. 2, lines 22-36, Page 852, Section VI. Review of the PI-Method, Page 853, Col. 2, lines 29-30 and Figure 6) as implied by Proksa et al.

Response to Arguments

6. Applicant's arguments see page 11, lines 2-4 of the Applicant's remarks/arguments, filed 13 August 2008, with respect to specification have been fully considered and are persuasive. The objection of specification has been withdrawn.

7. Applicant's arguments see page 14, lines 24-26 of the Applicant's remarks/arguments, filed 13 August 2008, with respect to at least claims 1 and 3 have been fully considered and are persuasive. The 35 USC 103(a) rejection of Katsevich (2002) as applied to at least claims 1 and 3 has been withdrawn.

8. Applicant's arguments see page 16, lines 6-9 of the Applicant's remarks/arguments, filed 13 August 2008, with respect to claim 4 have been fully considered and are persuasive. The 35 USC 103(a) rejection of Katsevich (2002) in view of Hsieh as applied at least claim 4 has been withdrawn.

9. Applicant's arguments filed 13 August 2008 have been fully considered but they are not persuasive.

With respect to at least claim 6, the Applicant argues that Turbell et al. fails to disclose weighting factors dependent on the location of the measuring value on the detector. The Examiner disagrees. Turbell et al. clearly discloses "pre-weighting of projection data with the cosine of the cone-angle" (Page 865, Col. 1, step 1). Therefore, Turbell et al. does disclose weighting factors dependent on the location of the measuring value on the detector and Turbell et al. still applies as prior art.

With respect to at least claim 15, the Applicant argues that Katsevich (2002) fails to disclose identifying a first voxel from a plurality of voxels within an examination zone to reconstruct. The Examiner disagrees. At least equations (9) and (13) show inversion formulas for reconstructing point x (a voxel at coordinates identified by x) from projections. The cone-beam reconstruction method reconstructs a volume consisting of a plurality of voxels, the volume being selected by an operator. Figures 1 and 2 show a selected/identified first point x (first voxel at x) from the plurality of voxels to be reconstructed in the examination zone which is reconstructed by inversion formulas (9) and (13) respectively. For inversion formula (9), Katsevich (2002) also discusses evaluating equation (9) for fixed x (Page 2586, lines 2-3). For inversion formula (13), Katsevich (2002) also discusses where the origin is placed at the reconstructed point x, thus a first voxel is identified from a plurality of voxels (Page 2687, line 10 and Figure 2). Therefore, Katsevich (2002) does disclose identifying a first voxel from a plurality of voxels within an examination zone to reconstruct and the claims remain rejected.

With respect to at least claim 15, the Applicant argues that Katsevich ('299) fails to disclose reconstructing the first voxel as a function of the first set of corresponding projection angles indicative of angles at which a radiation beam traverses the first voxel. The Examiner disagrees. As the source and the detector progress along a helical trajectory the position of image of each voxel, to include first and second voxels, change from projection to projection (See Figure 3 for example). The projection image of a first voxel, therefore, is a function of a first set of corresponding projection angles indicative of angles at which a radiation beam traverses the first voxel. Similarly, projection image of a second voxel is a function of a second set of

corresponding projection angles indicative of angles at which a radiation beam traverses the second voxel. In order to reconstruct an image of the object which is formed from a plurality of voxels, a backprojection takes place (Step 50) via an inversion formula (equations 10 and 13 for example). As noted in steps 53-56, the contribution of the cone beam data for a given projection is determined as a result of a filtering process. The filtering process requires a filter direction which is a function of corresponding projection angles indicative of angles at which a radiation beam traverses the first voxel. Filtering directions are voxel and projection angle dependent. Therefore, Katsevich ('299) does disclose reconstructing the first voxel as a function of the first set of corresponding projection angles indicative of angles at which a radiation beam traverses the first voxel and the claims remain rejected.

Allowable Subject Matter

10. Claims 8-14 and 18-19 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter:

With respect to claim 8, the prior art fails to teach or reasonably suggest a method including determining a partial derivative of the measuring values;

performing a weighted-integration of the partial derivative; and

reconstructing the integrated partial derivative to generate the image, when taken in combination with the other limitations of each respective claim. Claims 9-12 indicate allowable subject matter by virtue of their dependency.

With respect to claim 13, the prior art fails to teach or reasonably suggest a method including reconstructing the measuring values as a function of the following:

$$-\frac{1}{2\pi^2}\int_0^{\pi} d\varphi \frac{\cos\lambda}{R\cos\varepsilon} p(y(s(\varphi)), \Phi(s(\varphi), x))$$, wherein,

$p(y(s(\varphi)), \Phi(s(\varphi), x))$ denotes a weighted integration of a partial derivative of the measuring values,

$\frac{\cos\lambda}{R\cos\varepsilon}$ denotes a weighting factor,

$\int_0^{\pi} d\varphi$ denotes an integration over the projection angles φ,

λ denotes a cone angle of the radiation beam;

ε denotes a fan angle of the radiation beam;

R denotes a radius of the helical trajectory;

x denotes a location in the examination zone;

$s(\varphi)$ denotes a parameter that is a function of φ;

y(s) denotes a function that indicates the radiation source position along a helical trajectory and is dependent upon the parameter s; and

Φ denotes a unity factor which points from the radiation source position y(s) in the direction of x, when taken in combination with the other limitations of each respective claim.

With respect to claim 14, the prior art fails to teach or reasonably suggest a method including reconstructing the measuring values includes reconstructing the measuring values as a function of the following:

$$-\frac{1}{2\pi^2}\int_0^{\pi} d\varphi p(y(s(\varphi)), \Phi(s(\varphi), x))\text{, wherein,}$$

$p(y(s(\varphi)), \Phi(s(\varphi), x))$ denotes a weighted integration of a partial derivative of the measuring values,

$\int_0^{\pi} d\varphi$ denotes an integration over the projection angles φ,

λ denotes a cone angle of the radiation beam;

ε denotes a fan angle of the radiation beam;

R denotes a radius of the helical trajectory;

x denotes a location in the examination zone;

s(φ) denotes a parameter that is a function of φ;

y(s) denotes a function that indicates the radiation source position along a helical trajectory and is dependent upon the parameter s; and

Φ denotes a unity factor which points from the radiation source position y(s) in the direction of x, when taken in combination with the other limitations of each respective claim.

With respect to claim 18, the prior art fails to teach or reasonably suggest a system with a reconstructor that determines the partial derivative of the measuring values, performs a weighted integration of the partial derivative, and integrates the weighted-integration of the partial

derivative of the measuring values, when taken in combination with the other limitations of each respective claim. Claim 19 indicates allowable subject matter by virtue of its dependency.

11. Claims 1-5 and 20 are allowed.

The following is an examiner's statement of reasons for allowance:

With respect to claim 1, the prior art fails to teach or reasonably suggest a method including the step of multiplying the integrated partial derivative of the measuring values by a second weighting factor which corresponds to the reciprocal value of the cosine of a fan angle of the beam associated with the measuring values, when taken in combination with the other limitations of the claim. Claims 2, 5 and 20 are allowed by virtue of their dependency.

With respect to claim 3, the prior art fails to teach or reasonably suggest a method including the step of multiplying the integrated partial derivative of the measuring values by a second weighting factor which corresponds to the reciprocal value of the cosine of a fan angle of the beam associated with the measuring values, when taken in combination with the other limitations of the claim.

With respect to claim 4, the prior art fails to teach or reasonably suggest an apparatus including a control unit configured to control a reconstruction unit in conformity with the step of multiplying integrated, derived measuring values by a second weighting factor which

corresponds to the reciprocal value of the cosine of a fan angle of the beam associated with the measuring values, when taken in combination with the other limitations of the claim.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JOHN M. CORBETT whose telephone number is (571)272-8284. The examiner can normally be reached on M-F 8 AM - 4:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Edward J. Glick can be reached on (571) 272-2490. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/J. M. C./
Examiner, Art Unit 2882

/Edward J Glick/
Supervisory Patent Examiner, Art Unit 2882